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STUDY OF GAS AND GAS-DISPERSED FLOWS IN SUPPORT OF THE DEVELOPMENT OF SPACE HARDWARE OBJECTS AND TECHNOLOGICAL PROCESSES

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This paper presents the mathematical models, algorithms, and programs developed in the past five years at the Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and the State Space of Ukraine for numerical simulation of gas and gas-dispersed chemically reacting mixture flows. The subject matter involves both space hardware development and scientific support of the development of technological processes. As to space hardware, the paper addresses issues of the development of methods and programs and their use in investigations along the following lines: the aerogasdynamics of full launch vehicle configurations with wings and controls, rocket propellant combustion product jet efflux with account for afterburning when mixing with air and for the effect of the injection of water drops on the jet parameters, air flows in air intake channels, mixing of a hydrocarbon fuel with a cocurrent air flow and its burning in ramjet combustion chambers, and the choice and substantiation of the design parameters of the liquid-propellant jet system of launch vehicle upper stages in the case where the control blocks are fed from the sustainer engine propellant lines. As to technological processes, consideration is given to the burning of dry and moisture-saturated coal particles in a hot fuel–air mixture flow and the effect of interaction of gas-dispersed flow particles with the channel walls and with one another on the formation of a gas – variously sized particles mixture flow. The topicality of this work is due to the need for upgrading existing space hardware elements and developing new ones and for increasing the efficiency of coal dust burning and gas-dispersed mixture transportation in air tube conveyers.

Keywords*: gas and gas-dispersed flows, chemically nonequilibrium mixtures, full launch vehicle configurations, supersonic rocket jets, jet mixing and afterburning, air intake, ramjet engine, liquid-propellant jet system, moister-saturated particle ignition and burning, self-oscillatory flow pattern, particle – channel wall collisions.*

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